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AFATL-TR-72-73

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AN INVESTIGATION OF INADVERTENT ARMING OF MK-82 AND M-117 GENERAL PURPOSE AND MK-82 SNAKEYE BOMBS

MUNITIONS CARRIAGE AND HANDLING BRANCH
BOMBS AND FUZES DIVISION

TECHNICAL REPORT AFATL-TR-72-73

APRIL 1972

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An Investigation of Inadvertent Arming of MK-82 and M-117 General Purpose and MK-82 Snakeye Bombs

Gordon S. Thorsvold, Captain, USAF

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FOREWORD

This report is based on an investigation performed at the Air Force Armament Laboratory (AFATL) in conjunction with the A-7D Seek Eagle program, Project 337AZ002. The investigation was performed from August 1971 to March 1972 by personnel from the Munitions Carriage and Handling Branch (DLJC) with support from the Munitions Compatibility Branch (DLGC).

Because of the near completion of the Seek Eagle certification program with the subject stores and because of the 21 March 1972 grounding of the A-7D and A-7E fleet, this report will terminate the present AFATL investigation of the inadvertent arming problem.

This technical report has been reviewed and is approved.

Norman S. Drake

NORMAN S. DRAKE, Colonel, USAF
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ABSTRACT

An investigation into the inadvertent arming of MK-82 and M-117 general purpose bombs and MK-82 Snakeye bombs was initiated after a review of flight test film from A-7D munition certification tests indicated that the bomb nose fuze was often arming when it was not intended to arm or before it was intended to arm. Data collected from approximately 45 flight test missions indicated that the primary variables which contributed to the high rate of inadvertent arming were ejector foot design, arming solenoid operation, and the wire routing procedures. The tests revealed that, by routing the arming wire on the lower side of the ejector foot and by use of the smaller design ejector foot, the rate of inadvertent arming can be substantially decreased but not eliminated. The tests also revealed that the operation of the arming solenoids in the safe mode was extremely unreliable. Based on the investigation, it is recommended that direct routing of the arming wire be tested and utilized for all general purpose bombs, that further work be done to establish a solution to the MK-82 Snakeye bomb inadvertent arming, and that the arming solenoid be further investigated under dynamic conditions.

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SECTION I

INTRODUCTION

An investigation of the inadvertent arming of MK-82 general purpose (GP), M-117 GP, and MK-82 Snakeye bombs was performed at the Air Force Armament Laboratory (AFATL) after recognition of the problem in August 1971. Approximately 45 flight test missions, primarily conducted for munition compatibility tests, were used to provide data for the investigation.

Although the A-7 aircraft was used as the test aircraft, the inadvertent arming problem is not limited to this A-7 aircraft but is common to all aircraft utilizing the multiple and triple ejector rack (MER/TER) and the standard arming wire configurations with the affected bombs. The inadvertent arming problem has resulted in suspension of the pilot option rigging on the A-7D. The pilot no longer has the option of releasing a MK-82 Snakeye bomb in the armed low drag configuration, thus resulting in a loss of operational flexibility.

The data obtained from the investigation were not adequate to effectively solve the problem; however, the study may be used as a basis for initiation of corrective action which should be a joint effort between AFLC (OOAMA and WRAMA) and AFSC/AFATL.

SECTION II

BACKGROUND

Investigation of the inadvertent arming problem was initiated after a review of flight test film from A-7D Seek Eagle compatibility tests indicated that the nose fuze vane on the MK-82 and M-117 GP and MK-82 Snakeye bombs was often arming (spinning) when it was not intended to arm or before it was intended to arm. Because of the safety implication of an apparent limitation in the capability to drop stores in the safe mode to prevent arming, the study was initiated as a secondary objective to the Seek Eagle store certification program. The study of inadvertent arming was a lower primary objective of the store compatibility test missions, and only a limited flexibility in mission planning was available for this investigation.

Beginning in August 1971, the A-7D Seek Eagle pilots were directed to release the MK-82 and M-117 GP bombs with the mechanical fuze switch in the safe position; thereby releasing all the bombs with the arming wire intact on the bomb after separation from the rack. The MK-82 Snakeye bombs were released with the mechanical fuze switch in the tail position. With the switch in this position, the nose fuze should not begin to arm (vane rotating) until the action of the fins opening extracts the wire from the vane.

Review of onboard flight test film was the primary method of data collection. Camera lenses with a longer focal length than normally used were utilized to provide a better view of the pertinent area. During the test period (3 August 1971 to 15 March 1972), approximately 45 missions were flown which yielded data used to define the variables contributing to the problem. These missions also were used to investigate solutions to the problem. The results obtained early in the program were similar for the MK-82 and M-117 GP bombs but were significantly different for the MK-82 Snakeye bombs; therefore, the investigation was separated into a GP bomb problem and a Snakeye bomb problem. Of the total missions flown, 25 were with MK-82 Snakeye bombs and 20 were with the M-117 or MK-82 GP bombs.

The arming wire procedures used with the MK-82 Snakeye bomb provided the pilot with an option during flight of either dropping a high drag or a low drag armed bomb or a low drag unarmed bomb. This pilot option rigging includes a fin release wire attached directly to a swivel and link in the aft solenoid. If the pilot selects tail arm, the arming solenoid will retain the fin release wire, allowing the fins to open and resulting in a high drag release. The fuze arming wire runs from the nose fuze (where it is held by a beryllium-copper (Be-Cu) clip), through the forward lug, through the link portion of a swivel and link attached to the nose solenoid, through the aft lug, and over the outside of the top of a fin and is then attached with a ferrule to the fin aft clevis bolt. If a high drag release is intended, the nose arming solenoid is not energized, allowing the swivel and link to pull out of the solenoid during release. The action of the fins opening extracts the arming wire from the nose fuze. The reason for this procedure is that

if the fins fail to deploy during a high drag release, the bomb will not arm and thereby expose the aircraft to possible damage from detonation while in the lethal envelope of the store. To demonstrate that this is indeed a valid concern, 193 MK-82 Snakeye bombs were released from aircraft during the investigation, and 14 went low drag when the fins failed to deploy. (Note: This problem is not associated with inadvertent arming). If an armed low drag release is intended, the pilot simply selects nose arming, and the nose solenoid retains the swivel and link, thus arming the bomb.

The arming wire used with the MK-82 and M-117 GP bombs is routed as follows. The nose fuze wire runs from the nose fuze (where it is held by a Be-Cu clip) through the forward lug, through the forward swivel and link (which is inserted in the forward solenoid), and is attached with a ferrule to the aft lug. The tail fuze wire runs from the tail fuze, through the aft lug, through a swivel and link (which is inserted in the tail solenoid), and is attached with a ferrule to the forward lug.

Missions conducted during the inadvertent arming study indicated a much greater rate of inadvertent arming with the Snakeye bombs than with the GP bombs.

SECTION III

INITIAL DETERMINATION OF CONTRIBUTING VARIABLES

During the initial missions, efforts were focused primarily on determination of the variables which influenced the rate of inadvertent arming. Data recorded during the first 26 missions included type of store, clip (fahnstock, Be-Cu, etc.), ejector foot design, swivel and loop/link, wire routing (upper or lower side of foot, outside lug, through lug, etc.), solenoid lip orientation, and solenoid safe pull force. Examination of these data indicated that the variables contributing significantly to the high rate of inadvertent arming were: (1) ejector foot design, (2) arming solenoid operation, and (3) wire routing procedures.

The method of analysis (review of flight test film), precluded collection of reliable data on the inadvertent arming of the tail fuze on the GP bombs. Some flight test film illustrated that inadvertent arming of the tail fuze was also occurring. However, the primary purpose of the Seek Eagle program was to obtain munition separation data and in many cases, the film resolution in the area of the tail fuze was not adequate to determine the magnitude of the problem. A discussion of each of the three primary variables follows.

1. EJECTOR FOOT DESIGN.

A review of the initial flight test film indicated that the arming wires were possibly hanging up on the ejector foot during release. Later, cameras with a longer focal length were focused on the area of the ejector foot, and it was definitely established that in some instances inadvertent arming was caused by the wire hanging up on the ejector foot.

To further establish that the foot was causing inadvertent arming, four missions were flown with no swivel and link attached to the solenoid (to eliminate solenoid malfunctions as a source of the inadvertent arming). Inadvertent arming occurred in three of 12 centerline station releases and in 11 out of 16 shoulder station releases indicating that the arming wire was definitely hanging up during release.

The USAF currently has two different ejector foot designs in the inventory. For the purposes of the inadvertent arming study, these were identified as the large foot and the small foot. Data gathered during preliminary missions indicate the rate of inadvertent arming was approximately 2-1/2 times higher with the large foot than with the small foot.

The large foot is the latest version of the ejector foot and, according to AFLC/WRAMA, includes approximately 90 to 95 percent of all the ejector feet in the active inventory. The large foot is a one piece truncated cone design. It has a 1.25 inch diameter base and a 1/8 inch flat at the top of an approximately 43 degree ramp.

The small foot is a two piece item that was used prior to the one piece large foot. It initially appeared as a flat 1.0 inch diameter foot. Soon after introduction of the small foot, it was determined that arming wires were hanging up on the foot during release. After discovery of the problem, a piece was added to provide a ramp that allowed the wire to slide off the foot. The approximately 40 degree ramp has a 1.0 inch diameter base with a flat of approximately 1/16 inch at the top of the ramp. By contrast, the Navy uses a much smaller foot (0.750 inch diameter base) with a steeper ramp angle (55 degrees) and no appreciable flat (approximately 0.008 inch) at the top of the ramp.

2. ARMING SOLENOID.

The standard arming solenoid (Air Force drawing 64D13223) is used on the MER/TER ejector units. Prior to 10 of the 45 missions, all the MER/TER solenoids were checked to determine whether or not the solenoid complied with the safe extraction force requirement of 10 to 14 pounds (Table I). The solenoids were tested with the direction of pull perpendicular to the longitudinal axis of the solenoid cone. The solenoid was tested with a slow pull to simulate the weight check requirement specified by the drawing and was also checked by a fast jerk to crudely simulate the dynamic condition which occurs during ejection. In the slow pull mode, the force required to extract the swivel and link from the solenoid varied from 10 to 59 pounds (four solenoids operated in excess of 30 pounds).

The arming solenoid was considered to be a contributor to the problem because inadvertent arming did occur in instances where the solenoid had been checked prior to the flight and was operating in excess of the safe extraction force of 10 to 14 pounds. It was not possible to determine the angle of extraction of the swivel and loop from the solenoid during release due to inadequate instrumentation. If the store rolled slightly during the extraction period, the force required to extract from the solenoid could increase significantly.

A recent investigation of this same arming unit configuration was performed by the Naval Weapons Center in an attempt to resolve an arming problem with the Rockeye II Mod 3 Weapon. That investigation indicated that serious deficiencies exist in regard to military specifications, arming unit designs, quality control of manufactured items, and in-service reliability. These results, in addition to reports from field activities, indicate that the arming solenoid is not adequate to reliably perform its required function.

3. WIRE ROUTING.

An analysis of the data gathered during the preliminary missions showed that the rate of inadvertent arming increased substantially when the wire was routed on the upper side (top) of the ejector foot on the MER/TER shoulder stations. Based on 75 bombs released from shoulder stations, the rate of

TABLE I. SOLENOID PULL TEST			
	NUMBER OF MISSIONS CHECKED	NUMBER OF SOLENOIDS CHECKED	NUMBER OF SOLENOIDS REQUIRING GREATER THAN 14 LB (Percent)
Slow Pull	10	258	88 (34%)
Fast Jerk to Simulate Release	10	236	188 (80%)
CLIP (Be-Cu) RETAINING FORCE			
Average of 10 slow pulls	22.5 lb		
Average of 10 fast pulls	23.5 lb		

inadvertent arming was 51 percent with the wire on top of the ejector foot as compared to 8 percent witn the wire on the lower side of the foot. Based on these data, all further tests were conducted with the wire on the lower side of the ejector foot. (Note: At the time that these data indicated the wire should be routed on the lower side of foot, CINCPACAF sent a message to its operational units requiring that the arming wire be routed on the lower side of the shoulder station ejector foot (CINCPACAF Msg 292332Z Nov 71)).

During the investigation of inadvertent arming, it became apparent that one of the primary causes of inadvertent arming is the use of banjo rigging. This method of rigging includes fastening the arming wire to the bomb (either by tying to the lug in the case of GP bombs or tying to the fin in the case of the Snakeye bombs). The arming wire is fed through the link portion of swivel and link which is attached to the solenoid. Since the wire is free to slide through the link, only the vertical components of the force acting on the wire can be reacted by the swivel and link. The reason for banjo rigging is that upon release the wire falls away with the bomb thus eliminating wire retention by the rack solenoid. If the wire is retained, damage to the aircraft can result from the wires whipping or the wires can break free and lodge in a control surface.

The primary flaw in the banjo rigging system is that the tensile force in the wire is always higher than the vertical force component which acts on the swivel and link because of the angle formed by the arming wire at the swivel and link. The Be-Cu clip operates quite reliably at a stripping force of approximately 22 pounds but it directly reacts to all the force on the arming wire. The long angle made by the wire stretched over the length of the bomb often results in the clip being stripped off the wire before the vertical force component on the swivel and link reaches the force of 14 pounds required to extract it from the solenoid.

The tests indicate that the solenoids often operate in the 14 to 18 pound range rather than from 10 to 14 pounds, and in many cases of inadvertent arming, it appears that the clip was stripped from the fuze wire prior to the extraction of the swivel and link from the solenoid.

SECTION IV

ESTIMATE OF CURRENT OPERATIONAL PROBLEM

An estimate of the inadvertent arming rate was made so that the problem experienced during the study could be related to that being experienced on a daily basis by the operational forces in Southeast Asia (SEA). The calculations were based on data collected during test missions in which the arming wire configuration was identical to that required by the loading procedures (T.O. 1A-7D-33) used in SEA. Because of the tight controls used during this test program, the estimate of inadvertent arming is probably on the conservative side. The data were adjusted to reflect the fact that in the field approximately 7 percent of the ejector feet are of the small foot type and 93 percent are of the large foot type (based on AFLC/WRAMA estimate of 5 to 10 percent small feet remaining in the active inventory).

1. CURRENT OPERATIONAL PROBLEM WITH MK-82 AND M-117 GP BOMBS.

The following data are based on 14 missions (Table II) during which 69 bombs were released from A-7D aircraft.

a. Of all bombs released in the safe mode from MER/TER centerline stations, 11 percent will inadvertently arm.

b. Of all bombs released in the safe mode from MER/TER shoulder stations, 10 percent will inadvertently arm.

NOTE: Although the data collected were not adequate to define the rate of inadvertent tail fuze arming, it was determined that inadvertent tail fuze arming was occurring. The incidence of tail fuze arming would be in addition to the estimated rate of inadvertent arming.

2. CURRENT OPERATIONAL PROBLEM WITH MK-82 SNAKEYE BOMBS.

The following data are based on eight A-7D missions (Table III) during which 62 MK-82 Snakeye bombs were released.

a. Of all bombs released in the safe mode from MER/TER centerline stations, 25 percent will inadvertently arm.

b. Of all bombs released in the safe mode from MER/TER shoulder stations, 44 percent will inadvertently arm.

TABLE II. INAOVERTENT ARMING OF MK-82 AND M-117 GP BOMBS

[Arming wires on lower side of foot]

DATE	BOMB	SMALL EJECTOR FOOT				LARGE EJECTOR FOOT			
		MER/TER CENTERLINE STATION		MER/TER SHOULDER STATION		MER/TER CENTERLINE STATION		MER/TER SHOULOER STATION	
		DROPPED	ARMED	DROPPED	ARMED	DROPPED	ARMEO	OROPPEO	ARMEO
23Dec71	MK-82 GP	4	0	*8	1				
210ec71	M-117	*2	0	**2	0				
90ec71	M-117	2	0					2	1
26Nov71	M-117			2	0	*4	1	*2	0
17Nov71	M-117					2	0		
12Nov71	M-117					3	0		
10Nov71	M-117	2	0			1	1		
4Nov71	M-117	2	0	2	0	2	0	2	0
280ct71	M-117	1	0	1	0	1	0		
270ct71	M-117					4	1	3	0
200ct71	M-117					2	0	1	0
190ct71	MK-82 GP			4	0	4	0		
130ct71	M-117	1	0			1	0		
70ct71	M-117					2	0		
TOTALS		14	0	19	1	26	3	10	1
% ARMEO		0		5		11.5		10	

* Plus one bomb tail-armed
** Plus two bombs tail-armed

TABLE III. INAOVERTENT ARMING OF MK-82 SNAKEYE BOMBS

[Arming wire on lower side of ejector foot - pilot option rigging]

OATE	SMALL EJECTOR FOCT				LARGE EJECTOR FOOT			
	MER/TER CENTERLINE STATION		MER/TER SHOULDER STATION		MER/TER CENTERLINE STATION		MER/TER SHOULOER STATION	
	OROPPED	ARMED	OROPPED	ARMED	OROPPED	ARMED	OROPPEO	ARMED
28Feb72	1	0			3	2	4	2
23Feb72	2	0	1	1	4	0	5	1
10Feb72	2	1	1	0	4	1	4	3
4Feb72			2	0	4	1	6	2
17Jan72	2	0	2	1				
7Jan72	4	0	4	2				
6Jan72	2	0	2	0				
15Oct71	1	0	1	1			1	1
TOTALS	14	1	13	5	15	4	20	9
% ARMED	7		38.5		26.5		45	

SECTION V
APPROACH TO DETERMINE
SOLUTION FOR MK-82 AND M-117 GP BOMBS

Only two test flights remained after it was determined that the frequency of inadvertent arming of GP bombs was greatly increased by use of the large ejector foot and by routing the arming wire on the upper side of the foot on shoulder stations. These two flights were utilized to obtain 16 additional releases using small ejector feet and with the arming wire routed on the lower side of the ejector foot of the shoulder stations. Including the additional 16 bombs dropped in this configuration, a total of 33 bombs were released with only one nose fuze failure (Table II). However, a new technique was used with the tail fuze to obtain better flight test film coverage, and the photographs showed that four of the last 16 bombs dropped definitely tail-armed. The routing method is identical for the nose and tail fuze, and these tail fuze failures reduced the confidence that the small foot and wire on the lower side of the foot provided an adequate solution to the GP bombs problem.

Various solutions to the problem of the wire hanging on the foot were considered (including several types of arming wire standoffs, routing outside the lugs, etc.). However, all of these were discarded as not feasible after they were fit checked or tried on the racks.

Because of the failures which occurred even with the most ideal conditions (small foot and wire on lower side), it was decided that the best solution to the inadvertent arming of GP bombs was direct routing. Direct routing consists of running the arming wire from the nose or tail fuze directly to the nearest solenoid. This solution would eliminate routing the arming wire past the ejector foot where it could hang up, and in addition, would provide a direct 1 to 1 relationship between the tensile force in the arming wire and the force on the solenoid. This relationship would make the force on the clip equivalent to the force on the solenoid so that a 14 pound force (if the solenoid could be assumed to operate reliably as specified) could pull the swivel and link from the solenoid before the clip is stripped from the wire.

The adverse effect of direct routing (the wires remaining on the aircraft) could be eliminated by incorporation of an AFLC/OOAMA proposal (Figure 1). This proposal includes adding a shear link and a break-away initiating component which would hang up on the lug, thus allowing the arming wire to fall away with the bomb.

To validate direct routing as a solution to the GP inadvertent arming problem, 12 bombs were released with the nose fuzing wire attached to the forward arming solenoid. Four bombs were released from the MER/TER centerline station and eight from the shoulder station, and all were successfully released safe as desired.

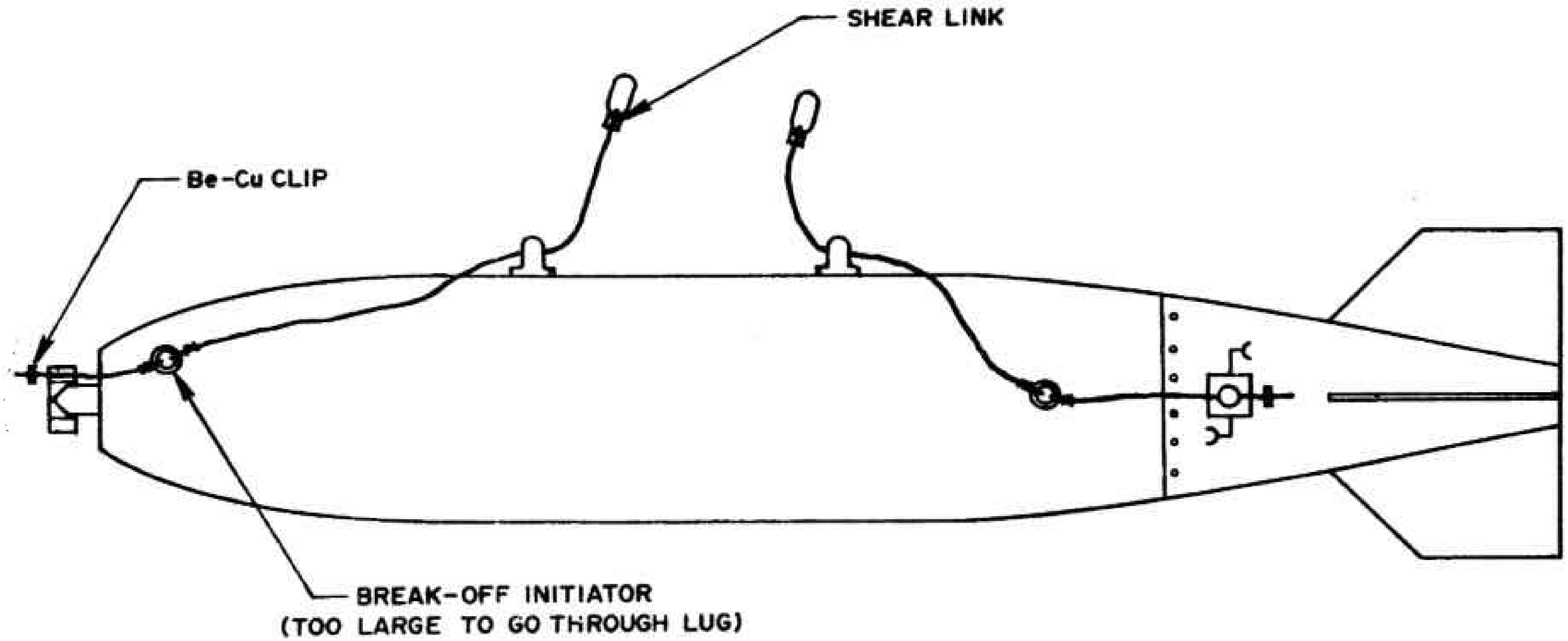

Figure 1. Direct Arming Wire Rigging

SECTION VI
APPROACH TO DETERMINE SOLUTION FOR MK-82 SNAKEYE BOMB

After the critical variables were determined during the initial flight test missions with the MK-82 Snakeye bomb, eight missions were conducted to determine the effect of using the small ejector foot and routing the wire on the lower side of the foot. The 27 MK-82 Snakeye bombs dropped in this manner indicated that inadvertent arming was still occurring at the rate of approximately 7 percent at the MER/TER centerline station and 38 percent at the shoulder station. Several tests were conducted with the arming wire routed outside the bomb lugs to keep the wire away from the ejector foot; however, the results indicated that, after release, the swivel and link would pull the wire over the ejector foot prior to release from the solenoid. This was verified when the releases without a swivel and link dropped safe but those with the swivel and link added had a high rate of arming.

The 7 and 38 percent inadvertent arming rates were unacceptable, and efforts were made to correct the problem. A pilot option lanyard was fabricated to allow the arming wire to remain taut against the bomb to prevent the wire from being pulled up over the foot by the swivel and link until the bomb had fallen away from the foot. The pilot option lanyard (Figure 2) consisted of two swivel and loops connected by 1/32 inch diameter steel wire cable to provide a total length of 6-1/4 inches. When the wire begins to be pulled by the swivel and loop, it is already beyond the ejector foot and therefore cannot hang on the foot.

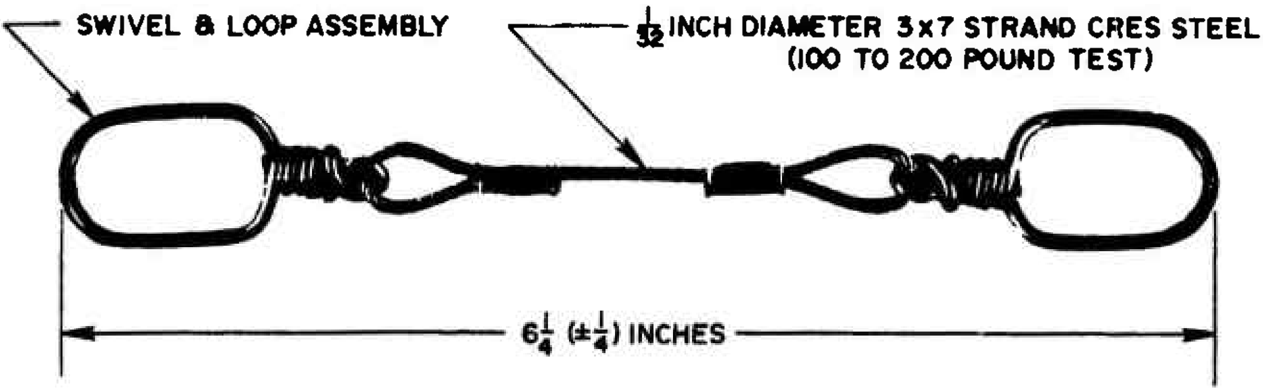

Figure 2. Pilot Option Lanyard

The initial results with one Be-Cu clip on the fuze wire were not favorable. A review of the film indicated that the wire was not hanging on the foot; however, the force on the wire was stripping the clip off the wire prior to extracting the swivel and link from the solenoid. In an attempt to alleviate this banjo effect, two Be-Cu clips were installed. Table IV indicates that the results were successful on the MER/TER centerline station but provided only partial relief of the problem on the shoulder stations.

TABLE IV. RESULTS WITH PILOT OPTION LANYARD ON MK-82 SNAKEYE BOMBS

[Two Be-Cu clips; wire outside under aft lug and through forward lug]

DATE	MER/TER CENTERLINE STATION DROPPED	ARMED	MER/TER SHOULDER STATION DROPPED	ARMED
15Mar72	4	0	2	1
14Mar72	2	0	4	1*
6Mar72	2	0	2	1
28Feb72	4	0	4	0
22Feb72	2	0	4	0
TOTALS	14	10	16	3
% ARMED	0		19	

*Broken pilot option lanyard returned.

[One Be-Cu Clip]

DATE	MER/TER CENTERLINE STATION DROPPED	ARMED	MER/TER SHOULDER STATION DROPPED	ARMED
6Mar72	2	1	*2	2
14Feb72	4	1	*4	4
10Feb72	2	1	*2	1
9Feb72	4	0	*4	1
8Feb72	4	0	**8	2
TOTALS	16	3	20	10
% ARMED	19		50	

*Wire outside aft lug

**Wire through aft lug

SECTION VII

CONCLUSIONS

The magnitude of the inadvertent arming problem in operational use is indicated in Section IV of this report. The use of banjo, or indirect, routing of the arming wire was considered to be one of the principal causes of inadvertent arming. The force required to strip off the Be-Cu clip (which holds the wire at the fuze) was often reached prior to achieving a vertical force component on the swivel and link sufficient to extract it from the solenoid. Also, the arming solenoids did not operate reliably in the specified 10 to 14 pound range; under conditions of a dynamic extraction, the force required for safe extraction was greatly increased over that of a near static condition.

For the MK-82 and M-117 bombs, the inadvertent arming problem was significantly reduced, but not eliminated, by using a small ejector foot and by routing the arming wire on the lower side of the ejector foot. The problem was reduced to 0 percent on the MER/TER centerline station and to 5 percent on the shoulder station.

For the MK-82 Snakeye bombs, the use of the small ejector foot with the arming wire routed on the lower side of the ejector foot resulted in an advertent arming rate of approximately 7 percent at the centerline station and 38 percent at the shoulder station.

The use of a pilot option lanyard with two Be-Cu clips on the nose fuze wire lowered the rate of inadvertent arming to 0 percent at the centerline station but only to 19 percent at the shoulder stations.

SECTION VIII

RECOMMENDATIONS

For the MK-82 and M-117 GP bombs, it would appear that the most feasible solution to the inadvertent arming problem is direct routing. A shear link which will allow the arming wires to separate with the bomb should be fabricated and tested (both in the safe and armed mode) and, if successful, should be used to eliminate banjo rigging. Flight tests should be conducted to insure that any piece added to cause the wire to shear will not be subject to flutter in the slipstream because this could extract the arming wire.

For the MK-82 Snakeye bombs a review of the validity of the requirement to have an inflight pilot option should be made. If the requirement is not valid, the arming wire could be routed under the bomb to provide a high drag release with nose fuze arming dependent on the action of the fins opening to pull the nose arming wire. If the pilot option feature is indeed a valid requirement, further testing of the pilot option lanyard to reduce the problem may be warranted.

Until a definite fix is established, all MER/TER loading technical orders should be amended to require that the shoulder station arming wire be routed on the lower side of the ejector foot. Also, the arming solenoid should be tested under dynamic conditions similar to those experienced during release of a store to determine the force required for extraction from the solenoid in the safe mode and to determine the reliability of the solenoid.

If subsequent interest in the problem is of sufficient magnitude, a design approach should be used to obtain a satisfactory solution. A new arming concept would be desirable; however, on a small scale, some of the problem could be eliminated by a new arming solenoid which would provide relatively no holding force in the safe mode (to allow reliable extraction). The solenoid should also have a neutral position that would require approximately 14 pounds to retain the clip in flight.

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UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Bombs and Fuzes Division Air Force Armament Laboratory Eglin Air Force Base, Florida 32542	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b. GROUP

3. REPORT TITLE
AN INVESTIGATION OF INADVERTENT ARMING OF MK-82 AND M-117 GENERAL PURPOSE AND MK-82 SNAKEYE BOMBS

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
Final Report (August 1971 to March 1972)

5. AUTHOR(S) (First name, middle initial, last name)
Gordon S. Thorsvold, Captain

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
April 1972	24	

8a. CONTRACT OR GRANT NO. b. PROJECT NO. 337AZ002 c. d.	9a. ORIGINATOR'S REPORT NUMBER(S) AFATL-TR-72-73 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10. DISTRIBUTION STATEMENT
Distribution limited to U. S. Government agencies only; this report documents test and evaluation; distribution limitation applied April 1972. Other requests for this document must be referred to the Air Force Armament Laboratory (DLJC), Eglin Air Force Base, Florida 32542.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
Available in DDC	Air Force Armament Laboratory Air Force Systems Command Eglin Air Force Base, Florida 32542

13. ABSTRACT
An investigation into the inadvertent arming of MK-82 and M-117 general purpose bombs and MK-82 Snakeye bombs was initiated after a review of flight test film from A-7D munition certification tests indicated that the bomb nose fuze was often arming when it was not intended to arm or before it was intended to arm. Data collected from approximately 45 flight test missions indicated that the primary variables which contributed to the high rate of inadvertent arming were ejector foot design, arming solenoid operation, and the wire routing procedures. The tests revealed that, by routing the arming wire on the lower side of the ejector foot and by use of the smaller design ejector foot, the rate of inadvertent arming can be substantially decreased but not eliminated. The tests also revealed that the operation of the arming solenoids in the safe mode was extremely unreliable. Based on the investigation, it is recommended that direct routing of the arming wire be tested and utilized for all general purpose bombs, that further work be done to establish a solution to the MK-82 Snakeye bomb inadvertent arming, and that the arming solenoid be further investigated under dynamic conditions.

DD FORM 1 NOV 65 1473

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14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
MK-82 General Purpose Bomb						
M-117 General Purpose Bomb						
MK-82 Snakeye Bomb						
Inadvertent Arming Problem						
Ejector Foot Design						
Arming Solenoid						
Wire Routing						
A-7 Aircraft						
Seek Eagle Tests						

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